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1980 ANNUAL REPORT To the Secretary of Agriculture



**Joint Council
on Food and
Agricultural Sciences**

January 1981

JOINT COUNCIL ON FOOD AND AGRICULTURAL SCIENCES

Secretariat:
Rm. 351A, Admin. Bldg.
U.S. Department of Agriculture
Washington, D.C. 20250

Honorable Bob Bergland
Secretary of Agriculture
Washington, D.C. 20250

Dear Mr. Secretary:

We are pleased to submit for your consideration the Annual Report for 1980 of the Joint Council on Food and Agricultural Sciences.

The Joint Council operates under authority of Section 1407, Public Law 95-113. Among the responsibilities of the Council according to that legislation is to:

"prepare and submit to the Secretary, not later than December 31 of each year, a statement of recommendations which shall include--

- (i) the Joint Council's recommendations as to unified national, regional, or interstate agricultural research, extension, or teaching programs to be implemented during the following fiscal year, delineating suggested areas of responsibility for Federal and State agencies in carrying out such programs, and the overall planning, evaluation, coordination, and support necessary for such programs, and
- (ii) a summary of agricultural research, extension, and teaching achievements made during, and the status of ongoing projects as of the end of the prior fiscal year, with respect to the programs conducted by the organizations represented by the members of the Joint Council."

The enclosed report contains the Joint Council's recommendations for areas in need of additional program emphasis during the next fiscal year. Specifically, the Council recommends that additional resources be directed toward selected, high-priority programs of research, extension, and higher education dealing with: (1) productivity and efficiency in the food and agriculture system, (2) energy conservation and production in agriculture and forestry, (3) human nutrition, and (4) natural resources.

The recommendations developed in the report probably do not go far enough to satisfy those who read the legislative charge to the Joint Council as a mandate for tightly-structured, centrally-planned programs designed to achieve specific national goals. Conversely, the recommendations might well exceed the bounds of acceptability for the most adamant proponents of a pluralistic, loosely-knit system responsive to a wide array of clientele groups or "grass-roots" issues. In any case, the Joint Council will continue to provide a forum for the interchange of information among program providers and users and will continue in its efforts to improve the overall planning, evaluation, coordination, and support necessary for programs in the food and agricultural sciences.

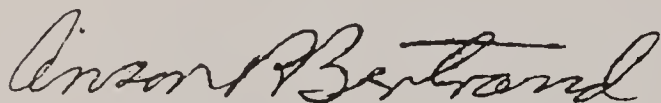
Honorable Bob Bergland

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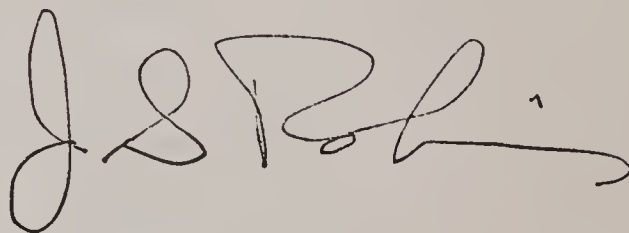
The enclosed report also includes summaries of significant achievements in agricultural research, extension, and teaching during the past year. While the report is far from a complete accounting of accomplishments or program status, we believe that it provides evidence of substantive progress and indicates the nature of the evolutionary process underway within the food and agricultural science system.

We appreciate this opportunity to brief you on Council activities. We would also like to assure you that the Joint Council stands ready to assist you in any way, in the words of its authorizing law, "...in carrying out the responsibilities assigned to the Secretary under this title through planning and coordination efforts in the food and agricultural sciences that utilize an effective system of regional and national planning, and by the development of recommendations and reports describing current and long-range needs, priorities, and goals in the food and agricultural sciences and means to achieve these goals.

Sincerely,



ANSON R. BERTRAND
Cochairman



J.S. ROBINS
Cochairman

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For copies of this report, please write to:
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EXECUTIVE SUMMARY

The Joint Council on Food and Agricultural Sciences was established under authorization of Section 1407 of Title XIV of the Food and Agriculture Act of 1977. The purpose of the Joint Council as set forth in the legislation is to foster and coordinate research, extension, and higher education in the food and agricultural sciences.

In its third year of activity the Council sought to strengthen its interaction with the National Agricultural Research and Extension Users Advisory Board; establish national planning committees for research, extension, and teaching; improve the Council's procedures for identifying and addressing priority issues; and specify more fully the Council's planning and coordination functions and mechanisms. Efforts were focused on developing an interactive flow between the Joint Council, the newly established regional councils, and the functional committees created at the national level. Issues surfaced and addressed in this process by the Council during 1980 related to reaffirmation and enhancement of the Federal/State partnership in research, teaching, and extension in our food and agricultural sciences system; the broadening of representation among performing organizations; and the importance of improving linkages between program planning and budgeting.

This report of the Joint Council discusses selected program accomplishments. Included are accomplishments both of the system of research, extension, and higher education represented by the Joint Council and of the Joint Council itself. Highlights of accomplishments in the program areas of human nutrition, integrated pest management, energy production and conservation, small farms, acid precipitation, and manpower assessment are provided in light of the special attention focused by the Council on these areas.

Drawing upon its efforts to develop a 5-year plan of program priorities, the Joint Council identified important programs which need to be emphasized in the year ahead. The food and agricultural science system should direct increased effort to issues dealing with productivity, energy, human nutrition, and natural resources. In addition to appropriate program redirection, real-dollar increased support will be required to impact these problem areas.

In 1980 commendable progress was achieved within the system on several major planning and coordination activities which had the encouragement of the Joint Council. A 5-year national plan for renewable resources extension was completed by SEA-Extension with the assistance of Cooperative State extension personnel and was reported to Congress. The fifth cycle of 5-year research projections was completed by the Interim National Research Planning Committee working with the Regional Planning Committees. The science and education system contributed, as appropriate, to the development of related components of the Resources Planning Act (RPA) Program and the Resources Conservation Act (RCA) Program. Joint budget displays were developed, along with an overview presentation highlighting the complementary aspects of the FY 1982 budget proposals of the USDA science and education agencies.

The Council gave special attention to development of suggestions for revision of Title XIV to be considered by Congress in 1981. These proposals are based either on the Council's experience of the past 3 years or on judgements of members of the research, extension, and teaching organizations the Council represents.

INTRODUCTION

Building on a rich heritage of past accomplishments, the many-faceted U.S. food and agricultural science system has continued to bring new knowledge and technology to bear on important and, in many respects, crucial issues facing the Nation and the world.

Although 1980 has not been a year of growth for the food and agricultural sciences, continued progress can be reported across a broad range of programs. To document all of the individual achievements or program accomplishments for such a complex system is well beyond the scope of this report. Thus, the aim is to: (1) highlight and summarize accomplishments in selected areas of the food and agricultural sciences where the Joint Council played a leadership or coordinating role, (2) document progress in improving the planning and coordinating processes employed within the food and agricultural science system, including the further development and functioning of the Joint Council structure for planning and coordination, and (3) recommend priorities for the coming year.

Accomplishments in Programs and Processes

Special emphasis is given to accomplishments in those program or issue areas singled out by the Joint Council on Food and Agricultural Sciences for study and coordination during the past 2 years. These include: human nutrition, integrated pest management (IPM), energy production and conservation, acid precipitation, small farms, and manpower assessment. Also included are descriptions of major process-improving activities carried out during the past year and recent program redirections within the system which indicate its responsiveness to changing needs and priorities.

Priorities

While progress has been made in both programs and processes, much more remains to be done. In many respects, the need for new knowledge and technology is more critical today than ever before as population growth and expectations for ever-higher standards of living strain against the limits of presently known resources. Opportunities abound for new or expanded programs in the food and agricultural sciences. A large number of these programs reasonably can be expected to yield rich future dividends, based on the past record of accomplishment and the present capabilities of the system.

Although needs and opportunities for expanded programs are practically limitless, resources to carry out such programs are not so plentiful. Compounding the problem is the fact that a given level of program operation in the future will surely cost more than at present. The same inflationary forces which impact households and production enterprises also affect the costs of research and education programs. Further, if the more complex issues and problems of the future are to be addressed, the science and education system will need to utilize newer and more costly technologies.

The Council's view is that the very highest priority should be given to maintaining strong base programs of research, extension, and higher education across the wide range of organizations and scientific disciplines comprising the food and agricultural science system. The Council recommends that, as a bare minimum, funding in support of the system, whether provided by Federal, State, or local governments or by the private sector, should increase proportionately to the rate of inflation in program costs. Implicit in this recommendation is the Council's view that one of the great strengths of the U.S. food and agricultural science system has been its capability to respond to a broad range of issues on relatively short notice because the needed scientific expertise and physical facilities were largely in place. The Council's concern is that this capability has been threatened in recent years due to the erosive effects of inflation and the stretching of limited resources across additional program thrusts.

The Joint Council recognizes that all worthwhile programs cannot be expanded to the levels deemed necessary or desirable by their proponents. The Council further recognizes that individual components of the food and agricultural science system must tailor their programs to their unique capabilities and responsibilities. However, the Council is in agreement as to the directions which should be taken overall to address future challenges and opportunities.

The Council's recommended priorities for real program growth during the coming year are expressed in terms of the following themes:

- **Increased Productivity and Efficiency in the Food and Agricultural System.**

The Joint Council recommends that additional resources be provided to programs designed to increase productivity in food, fiber, and forest production and marketing. This is a reflection of the Council's concern that many of the scientific breakthroughs which resulted in rapid and sustained productivity gains in the past have been almost fully exploited. The store of knowledge must be replenished through additional basic research and translated into new technology as quickly as possible through expanded programs of applied research and education.

- **Energy Conservation and Production.**

The Joint Council recommends that high priority be assigned to expansion of programs on energy in agriculture. The importance and cost of energy at virtually all stages of the production-distribution process for agricultural and forest products makes new or enlarged energy programs imperative if the food and agricultural science system is to meet the needs of the clientele groups which it serves. The potential for expanded use of agricultural resources or raw materials as

alternative energy sources coupled with the present capability within the food and agricultural science system to address this potential, provide further impetus for expanded programs. The Joint Council feels that the interest of the Nation can better be served by utilizing the research and education systems presently in place to deal with the issues of energy in agriculture than by building duplicate systems to accomplish the same objectives.

- **Human Nutrition.**

The Joint Council recommends that additional support of research, extension, and higher education programs in human nutrition remain a high priority. Efforts to augment research capabilities in human nutrition at the Federal level are underway and should not be interrupted in midstream. Additional coordinated efforts to augment other components of the system are also recommended so the entire spectrum of programs from basic research to nutrition education is included.

- **Natural Resources.**

Resource issues have become more prominent in recent years and all evidence points to their increasing importance in the future. For example, water has been identified by many as the most critical or limiting factor for both agricultural and industrial development in the years ahead. Soil erosion, water and stream pollution, and deterioration of range resources from excessive or inappropriate use are other examples of critical natural resource issues. Consequently, the Joint Council recommends a wide range of programs in this general field for high-priority treatment and support.

The remainder of this report elaborates more fully on progress and priorities in the food and agricultural sciences. The following section sketches the present structure and functions of the Joint Council and related coordinating bodies. This is followed by overviews of both program and process accomplishments within the system during the past year. The final section enlarges on the program priority recommendations of the Joint Council in each of the areas described above.

THE JOINT COUNCIL: OBJECTIVES, MEMBERSHIP,
STRUCTURE, AND INTERACTION WITH THE
USERS ADVISORY BOARD

The Joint Council on Food and Agricultural Sciences, as charged by Title XIV of the Food and Agriculture Act of 1977, is to bring about more effective research, extension, and higher education in the food and agricultural sciences.

The Joint Council's primary objective is to improve planning and coordination among all of the major performers of agricultural research, extension, and higher education. These performers are summarized in Figure 1. Through improved planning and coordination, performers should be able to:

- Strengthen the responsiveness of the system to the needs of the users of food and agricultural science and education.
- Increase benefits to society from food and agricultural science and education.
- Make more effective use of public and private resources devoted to food and agricultural science and education.
- Acquire knowledge of the social, economic, and environmental impacts of science and education and use this knowledge in setting program priorities.
- Develop stronger public understanding of and support for food and agricultural science and education.

Membership

The congressional mandate requires that a broad range of organizations from the food and agriculture science community be represented on the Joint Council. Membership includes representatives of:

- Land-Grant Colleges and Universities
- Non-Land-Grant Colleges and Universities
- Foundations
- Private Industry
- U.S. Department of Agriculture
 - Economics and Statistics Service
 - Forest Service
 - Science and Education Administration
- National Agricultural Research and Extension Users Advisory Board (two members elected to the Council)

Figure 1. THE U.S. FOOD AND AGRICULTURAL SCIENCE SYSTEM

COOPERATIVE STATE INSTITUTIONS:	USDA SCIENCE/EDUCATION AGENCIES:	OTHER FEDERAL AGENCIES:
<ul style="list-style-type: none"> — Land-grant colleges or universities in each State as authorized by Act of 1862, plus 16 colleges of 1890 and Tuskegee Institute with programs of higher education in food and agricultural sciences — Fifty-six State agricultural experiment stations (many with networks of substations) plus 16 schools of forestry, plus certain schools of home economics and vet. medicine with research programs partially supported by Federal formula funds. Research spending by Federal estimated at nearly three-quarters of a billion dollars in FY 1980 involving approximately 7,000 science years of research effort — Cooperative Extension Services in all 50 States plus D.C. and U.S. territories. With total funding at approximately \$600 million last year, Cooperative Extension programs involved over 17,000 professional staff years plus nearly 6,200 paraprofessional staff years, plus significant involvement by volunteers <p>OTHER COLLEGES AND UNIVERSITIES:</p> <ul style="list-style-type: none"> — Approximately 50 non-land-grant, state-supported colleges or universities with programs of higher education, research, and outreach in food and agricultural sciences — Other public and private institutions of higher learning ranging from major multi-disciplinary universities to specialized vocational centers or institutes 	<p>USDA SCIENCE/EDUCATION AGENCIES:</p> <ul style="list-style-type: none"> — The Science and Education Administration (SEA): <ul style="list-style-type: none"> — Inhouse research and information (Agricultural Research, Human Nutrition, and Technical Information Systems). Funding totaled \$380 million in FY 1980 involving 3,100 science years of research plus technical information services including the National Agricultural Library — Cooperative Research with funding of \$187 million in FY 1980 mainly channeled to the Cooperative State research system on formula basis, also includes competitive and special grants and Federal administration — Extension with funding of \$273 million in FY 1980, mainly channeled to the Cooperative Extension system; also includes Federal administration — Higher Education with funding of \$11.5 mil. in FY 1980 channeled to land-grant system under Bankhead-Jones authority — The Economics and Statistics Service (ESS, formerly ESCS) with funding of \$88 mil. for FY 1980, for about 500 SY's of economic and social science research and analysis plus major statistical reporting functions — The Forest Service (Research Divisions) with funding of \$109 million in FY 1980 provided nearly 1,000 SY's of research in resource management and utilization plus resource protection functions — Other USDA agencies with limited S and E roles: <ul style="list-style-type: none"> — Office of International Cooperation and Development — The Soil Conservation Service — The Agricultural Marketing Service — Office of Transportation — The Agricultural Cooperative Service 	<p>OTHER FEDERAL AGENCIES:</p> <ul style="list-style-type: none"> — At least 14 Federal Departments, Commissions, or Independent agencies besides USDA either conduct research and education programs closely related to agricultural and forestry or provide funds to support programs in the USDA-State system. Total funding for such programs in FY 1980 estimated at app. \$600 million. <p>PRIVATE FIRMS:</p> <ul style="list-style-type: none"> — R & D performed by equipment, seed, fertilizer, and other input suppliers: producing, processing, and distributing operations; and specialized private R&D firms. No hard data on total funding or specific personnel. (Unpublished data from NSF estimates industry R&D related to farming, post-farming, and forestry at nearly \$1.8 billion in 1979, about 1½ times as large as the USDA-State research system funding) — Technical information dissemination similar to some functions of Extension performed by field personnel or buyers of farm commodities, dealers of farm inputs, trade journals or publications including the farm press, and specialized technical information or consulting firms <p>OTHER PRIVATE ORGANIZATIONS:</p> <ul style="list-style-type: none"> — Foundations or similar organizations which facilitate or channel funds to research and/or education programs in the public sector — Associations formed by private firms to conduct research and/or educational programs for their members

Structure for Planning and Coordination

To carry out its congressional charge, the Joint Council is establishing a committee structure to facilitate planning and coordination. This structure will provide the capacity to approach planning and coordination on either a functional basis (within and across the functions of research, extension, and teaching) or a geographical basis (at the regional and national levels).

Regional functional committees for research, extension, and teaching are focal points for regional planning and coordination within a function. Models for these are the Regional Research Planning Committees established under the Agricultural Research Policy Advisory Committee (ARPAC) and continued under the Interim National Research Planning Committee of the Joint Council.

Regional functional committees communicate with regional councils, which address concerns of the particular regions that cross-cut all three functional areas. Regional functional committees also relate to national committees for teaching, research, and extension. The national committees develop national plans and priorities for each function. The Joint Council, then, receives cross-function, regionally integrated information from the regional councils and national plans for program areas from the national committees.

Concurrently with developing its committee structure, the Council has carried out a number of planning and coordination activities on an ad hoc basis and endorsed the continuation of activities started before the Council was formed. The Interim National Research Planning Committee and the regional planning committees released the 1979-84 cycle of projections for research program adjustments under the auspices of the Joint Council. Development of a 5-year plan delineating programs to be emphasized in the food and agricultural sciences was led by an ad hoc committee of the Council. During 1979, the Council gave special coordination attention to human nutrition, integrated pest management and small farms. In 1980, work has continued on integrated pest management and human nutrition; and energy in agriculture was added as an area for special coordination efforts.

It is likely that the Council will continue to need ad hoc committees for special purposes. However, when all elements in its structure are functioning, the amount of ad hoc planning and coordination activities likely will decrease.

Joint Council/Users Advisory Board Interaction

Title XIV established the National Agricultural Research and Extension Users Advisory Board (UAB) and gave it the general responsibility of preparing independent advisory opinions on the food and agricultural sciences. To further the exchange of information and opinions between the providers of agricultural research and the users, two UAB members are elected to serve on the Joint Council.

Also, Title XIV legislation requires that the Joint Council and Users Advisory Board hold at least one joint meeting per year. At the July 1980 meeting, work groups composed of both Joint Council and UAB members exchanged

views concerning five of the priority issues identified in the Board's 1979 report. The groups reported the results of their discussions as follows:

- **Basic Research**

- The group agreed that basic research concerns should reach beyond production to food marketing, conservation, and consumption and should embrace public and private sector performers. Further, "basic" needs to be better defined to show the linkage between the acquisition of new knowledge and the development of new technology.
- Those locations and programs in the research system having the strongest basic research capabilities need to be better identified.
- Studies need to be conducted to determine an optimum basic research/mission research expenditure ratio.
- General agreement existed that the most neglected area in both basic and applied research, at least in the public sector, is that of post-harvest technology.

- **Nutrition**

- The members of this joint work group expressed strong support for the USDA/HHS Dietary Guidelines and cited the need for study of the incongruity between current nutrition and health recommendations and current research and extension spending and policies.
- The consideration of nutrition and health trade-offs should extend beyond production-choice decisions to include marketing, distribution, and other decisions.
- More research is needed on the interrelationships of various nutrients and on nutrient requirements. Current standards for determining desired nutritional status should be improved.
- Less developed countries and regions of the U.S. should be assisted in improving their human nutrition research capability and food self-sufficiency.
- Study and expanded development of urban nutrition education centers are needed.

- **Structure of the Food and Agriculture System**

- The group noted that the UAB recommendations focus only on a narrow range of the full spectrum of structural concerns.
- The Green Thumb pilot information program needs to be expanded to help farmers respond to economic complexity.
- Increased research and extension work to improve food and fiber product price competition is needed.

- More market information needs to be developed and transmitted to users on a more timely basis.
- Work on the various forms of farm ownership needs to be greatly increased.
- Various categories of family farms need to be differentiated and research and education programs targeted accordingly.

● Energy

- In-depth studies of future energy needs, including analyses of current use patterns, should be conducted.
- Great urgency exists for increased "hands-on" education and demonstration of known alternative energy sources for food and agricultural uses.
- Extension education programs should be improved to inform users of advantages and trade-offs involved in various energy conservation practices.
- Increased work is needed to identify and implement practices to reduce petroleum use in food and agricultural processing.
- More study of energy-efficiency measures for local versus concentrated production of various commodities is needed.
- Improved energy efficiency in food storage is increasingly important.

● Food Security

- Food security is both a domestic and a world issue, and an assessment of the adequacy of U.S. food production and supplies in light of the world food situation is needed.
- It should be recognized that although in some instances food crises may result from real inadequacies in food supply, food crises may more often be the result of world prices, inventory practices, and distribution bottlenecks which make food unavailable to many people in spite of overall adequate supplies. While research and extension concerning both types of causal factors are needed, emphasis should be placed on distributional factors.

Also during the July meeting, members of joint work groups exchanged views about the roles and responsibilities of their respective organizations and how each could contribute to improved mutual effectiveness.

These groups saw the UAB as providing an important, valuable linkage between users and performers. UAB-identified priorities and alternatives to established procedures are valued by the Council. Accordingly, Council members suggest that increased UAB participation in discussions and decisionmaking

of administrative heads of science and education organizations is desirable, and that the UAB should seek broader communication with user constituencies represented in its membership.

The role of the Council was viewed as that of identifying priority problems and issues so the efforts of performers will be strengthened or modified as necessary to meet priority needs. UAB members suggested that the Council develop a cross-agency inventory of research and extension programs and that efforts to improve communication with users be increased.

PROGRAM STATUS AND ACCOMPLISHMENTS IN SELECTED AREAS OF EMPHASIS

This section highlights program status and accomplishments in high priority issue areas chosen by the Joint Council on Food and Agricultural Sciences for study and coordination. These include: human nutrition, integrated pest management, energy production and conservation, acid precipitation, small farms, and manpower assessment. It should be stressed that this is far from a complete catalogue of the accomplishments or contributions to knowledge for the entire system. Rather it is an illustration of programs and accomplishments in the selected areas.

Human Nutrition

The food and agricultural science system supports a broad spectrum of research, extension, and higher education programs in human nutrition. The Joint Council selected human nutrition as an area that should receive special consideration and coordination efforts during 1979-80.

In March 1980, the ad hoc committee appointed by the Council published their report Research, Extension and Higher Education in Human Nutrition. The report included: (1) an inventory of work underway, (2) identification of gaps in human nutrition programs, and (3) specification of coordination needs.

Program Accomplishments

- Progress was made toward an important consensus in national human nutrition policy in 1980, when the Department of Health and Human Services and the Department of Agriculture published comprehensive dietary guidelines. In summary, the following points were made:
 - Eat a variety of foods.
 - Maintain ideal weight.
 - Avoid too much fat, saturated fat, and cholesterol.
 - Eat foods with adequate starch and fiber.
 - Avoid too much sugar.
 - Avoid too much sodium.
 - If you drink alcohol, do so in moderation

While agreement exists on the general direction of the dietary guidelines, there is some disagreement regarding dietary fat and cholesterol. The National Academy of Science suggests the average person does not need to be worried about fat intake. Additional scientific evidence remains to be developed on this and other food and health issues.

- The publication of the new dietary guidelines has resulted in additional demands on education and information programs. A booklet has been prepared for the general public that illustrates dietary recommendations and guidelines with example foods and menus. The booklet explains each of the guidelines in terms of food choices; offers a week of low-calorie menus; and shows how the menus can be adapted to meet the needs of different people.
- Progress towards mapping a research program agenda for the field of nutrition education was made by a national conference involving 120 nationally and internationally recognized experts in many fields related to nutrition research and education. The conference purpose was to examine theoretical underpinnings and parameters of nutrition education research, which emerge largely from behavioral and educational research. The conference was followed by a series of five 2-day workshops focused on high-priority areas of nutrition education research.
- The USDA's nutrient data bank on the nutrient composition of foods has been further developed. The progressive development of the nutrient data bank is linked with the revision of Agricultural Handbook No. 8 entitled Composition of Foods. To date, seven sections have been published: Dairy and Egg Products; Spices and Herbs; Baby Foods; Fats and Oils; Poultry Products; Soups, Sauces, and Gravies; and Sausages and Luncheon Meats. Work is underway on all remaining food groups.
- Information on household food consumption and individual food intake is being released based on the 1977-78 surveys. Copies of the computer tapes have been released to the National Technical Information Service (NTIS) for public distribution on a nonprofit basis.
- "Food, Nutrition, and Health" represent a major thrust area in the recently completed comprehensive national plan for new initiatives in home economics research, extension, and higher education. The initiatives, or urgently needed areas for new or expanded efforts, which are identified are: Consumer use of dietary recommendations, multiple approaches to nutrition education, safety aspects of home food preparation, nutrition referral services and professional preparation. To guide the implementation activities over the decade of the 1980's, program targets for 2, 5, and 10 years are defined. This comprehensive plan is already being used in budget processes for 1982 and 1983.
- Considerable progress has been made in establishing a Western Human Nutrition Research Center in California. A Memorandum of Understanding has been signed between the Department of the Army and the USDA transferring the Army nutrition programs, various personnel, and equipment to the USDA. A program planning committee with representation from the University of California, USDA Food and Nutrition Service, and SEA met to develop the mission for the Center, which is as follows:
 - Identify factors, forces, and trends resulting in malnutrition.
 - Develop reliable, efficient, and inexpensive methods for defining nutritional status.

- Plan and conduct research on human nutritional requirements.
- Develop nutritional criteria for design and evaluation of intervention programs.
- The Children's Nutritional Research Center in Texas continues to develop. Its mission is to quantify nutritional allowances and determine the optimal nutritional status for pregnant and lactating women and for children from conception to adolescence. Since the Center was activated in November 1979, three laboratories have been developed.
 - The Nutritional Requirements of Lactation Laboratory has been established. A behavioral study component has been added to the program, in cooperation with the Food and Nutrition Service, that provides the opportunity to investigate and improve the frequency of lactation among those U.S. women whose infants have the greatest risk of malnutrition.
 - The Nutritional Requirements of Weaning Laboratory has been established to, among other objectives, develop recommendations for the feeding of infants participating in the WIC program and determine the risk factors which make these children susceptible to malnutrition.
 - A Stable Isotope Research Laboratory was established to determine the nutritional requirements of normal children without exposing the research subjects to significant risk.
- The Human Nutrition Research Center at Tufts University also developed further in 1980. The phase-one construction of the new 15-story facility is completed. A program involving aging humans has as its objective to study the importance of dietary protein in maintaining tissue function during the aging process. Preliminary evidence suggests that the elderly may need more dietary protein than do young adults.
- The Economics and Statistics Service has continued to research issues related to the economics of food consumption and food costs. Included are studies concerning the effects of product labeling and open dating, problems of transporting fresh produce, the structure and performance of food retailing, and food-stamp redemptions. Some of these studies involve cooperative arrangements with the State agricultural experiment stations and other collaborators.
- Research projects in the land-grant system are focusing on key problem areas in human nutrition as follows:
 - A regional research project in the West is focusing on the biological availability of the water-soluble vitamins and trace elements contained in specific foods. They are also investigating factors which affect the availability of these nutrients in the body.

- Researchers from several universities are conducting coordinated studies of natural, modified, and/or processed food fat to learn more about the basic metabolic and physiologic functions of these dietary components.
 - Researchers in the South launched a 5-year project to profile the nutritional health of adolescent girls 12-16 years of age. Their data will provide a base profile with which future profile surveys can be compared.
 - Nutritional researchers in the Northeast region are studying the nutritional status of high risk segments of the population and how diet modification can improve their nutritional status.
- During FY 1980, State extension nutritionists have continued to provide research-based nutrition information to over 4,000 county home economists for use in educational programs for local citizens. Individuals with expertise in evaluation, food science, and maternal nutrition have been added to the SEA-Extension staff to provide additional assistance to the States in these areas.
 - The Food and Nutrition Information Center (FNIC) recorded a tripling of requests for reference services in FY 1980 (from 565 to 1,546). Users of reference services are schools, State departments of education, universities, and colleges (24%); unaffiliated individuals (27%); USDA (17%); private interest groups/private industry (15%); hospitals (7%); and other government agencies, including Congress (10%). Groups of school librarians, sponsored by the National Institute of Education, visited the FNIC on a regular basis last year. Out-reach and on-line computer searching has increased contacts with over 4,000 dietitians and nutritionists, resulting in increased demand on resources. Considering a multiplier effect, it is estimated that in FY 1980 approximately 8,000 food service staff, 9,000 teachers, and 11,000 consumers benefited from the use of FNIC resources due to reference and out-reach efforts alone.

Integrated Pest Management

The USDA and the land-grant system have developed a cooperative effort to focus on new approaches and strategies for integrated pest management (IPM). Coordination of this cooperative program at the national level has centered in the Ad Hoc Committee on IPM, appointed by the Joint Council, and in the SEA-IPM Coordination Committee.

The planning and establishment of research priorities for IPM programs are also coordinated at the State and regional levels. At the State level, research priorities are developed by the individual experiment station directors, working with their discipline departments, in cooperation with extension and resident instruction administrators. In each of the four regions, specific IPM programs are being conducted by interdisciplinary teams and special committees have been appointed to coordinate these activities.

Research emphasis in IPM during FY 1980 has been on the development of pest-resistant crops, and on biological, cultural, and chemical pest-control methods. These research efforts, while diverse in nature, can be classified as either basic, component, or systems science research on management of pests. Included in systems research is specialized research to adapt generalized IPM systems to local, State, or regional conditions. Specific objectives have been pursued in: (1) fundamental biology, (2) improved methods of pest control, (3) improved pesticide use patterns, (4) toxicology, pathology, metabolism, and fate of pesticides, and (5) economics of pest control.

IPM is implemented through education. Therefore, the land-grant system, with its interactive programs of teaching, research, and extension, has been in the forefront in developing effective IPM programs aimed at farms and communities. These programs have been designed to: (1) develop and implement effective IPM systems to prevent or mitigate losses caused by pests through use of biological, cultural, chemical, and combined methods of control, (2) implement practical methods for monitoring pest populations in farm and other agro-ecosystems, and (3) provide farmers and others in private business with information and training in the principles of IPM.

Program Accomplishments

- As the concept of IPM has developed, the acute need for personnel with the proper formal education to communicate the systems concept at the operational level has become an increasing concern. As a result, the number of special IPM degree programs in higher education has increased, but these interdisciplinary offerings are relatively new. The development and implementation of IPM has, therefore, been largely dependent upon discipline-trained specialists and practicing agriculturalists who have broadened their training. The academic community has continued to express the need for support at the national, State, and local levels for IPM educational programs leading to baccalaureate, master's, and Ph.D. degrees.
- During FY 1980 each of the four regional IPM committees continued to develop innovative programs in research, extension, and education focusing particularly on establishment of program priorities and development of cooperative efforts. Specific areas emphasized follow:
 - Southern Region: Following the organization of the Southern Regional IPM Administrative Committee and IPM Technical Advisory Committee, three overall objectives for IPM for the Southern Region were identified. These were: (1) to provide technical and post-graduate education in IPM, (2) to conduct research in applied IPM for production of five commodities (livestock, peanuts, vegetables, turf-ornamentals, and soybeans) of high priority to the Southern Region, and (3) to develop and implement IPM programs for growers and users of these commodities. The need and importance of basic and fundamental research to support these programs were emphasized, as was the need for additional manpower and funding.

- Western Region: An IPM program has been developed for the Western Region that deals with two ecosystem types: irrigated agriculture and range. The commodities being given priority are potatoes, sugar beets, cotton, corn, alfalfa, and cereals. The latter two bridge the two ecosystem types. The program has identified objectives, personnel, and a planned schedule of operation. An IPM coordinator has been employed to administer these broad-based programs.
- Northeast Region: Following completion of the document "A Regional Approach to Integrated Pest Management in the Northeast--Research, Extension, and Teaching," four working groups were established for the following: fruit, vegetables-potatoes, dairy-forage, and urban IPM. Detailed program proposals were prepared in the areas of dairy-forage and urban IPM, and plans have been made to proceed quickly with the other two areas.
- North Central Region: Two planning meetings have been held in the North Central Region, which is in the process of developing a broad based IPM plan.
- Seven projects have been set up within SEA-AR under the recently established Special Research Program in Integrated Pest Management Systems. These involve:
 - Integrated systems for managing potato pests.
 - IPM in no-tillage systems for forage crops, and rotations involving forage crops.
 - IPM for crop production in the eastern Corn Belt.
 - A systems approach to IPM in irrigated crops.
 - IPM systems for horticultural crops.
 - Pest control in soybeans through manipulation of management techniques.
 - An IPM system for control of dogfly and other filth-breeding flies.
- Studies of the costs of substituting non-chemical control practices for chemical control have been conducted by ESS working with several State agricultural experiment stations. These studies have involved soybean cyst nematodes, citrus thrips, alfalfa weevils, fly pests of livestock, green peach aphids, and range weeds. Studies have also been conducted on the comparative profitability of early warning systems for pests, and an interdisciplinary team has been formed to examine the implications of using nosema, a protozoan disease, to control grasshoppers.
- Extension IPM programs are now conducted in all 50 States plus Puerto Rico and the Virgin Islands. These programs, which are aimed at providing the technical information needed for implementation of IPM, have expanded during the past year in terms of the disciplines involved

as well as the acreages and commodities covered. Publications were issued during the year with regional or national application, including the following: Corn Pest Management for the Midwest; Cotton Pest Management Scouting Handbook; and Fact Sheets on Apple Pests, including Diseases and Insects (with color plates).

- Under the leadership of the Council on Environmental Quality (CEQ), a review of IPM activities of governmental agencies was conducted. This review recommended the establishment of IPM Task Forces in six areas of society. One of these task forces is in agriculture and will have the responsibility to monitor and coordinate the implementation of agricultural IPM activities by agencies of the government.
- The Fifth Annual Beltsville Symposium in Agricultural Research, held in May 1980, was dedicated to Biological Control in Crop Production. Biological control of pests is a cornerstone of IPM. The state-of-the-art of biological control was presented in a major exposition of this facet of pest management.
- A special symposium on the assessment of crop losses was conducted in Minneapolis in August 1980. Accurate assessment of losses is essential to set priorities in pest control and thus becomes a prerequisite for functional IPM. Losses by both biotic and nonliving agents were addressed. Significant efforts towards developing scientific techniques for accurately quantifying losses and relating this information to agricultural, economic, and social needs were reported.

Energy Production and Conservation

Increased productivity in American agriculture has been dependent on a relatively inexpensive supply of energy and the replacement of human power with mechanical power. The decade of the 1970's brought a substantial increase in energy costs. As a result, the agricultural science and education community must address the problem of reducing energy costs and energy dependence if U.S. agriculture is to meet the needs of American citizens and others for adequate amounts of high-quality food, fiber, and wood products at reasonable prices. Also, American agriculture has the opportunity and challenge to contribute to the production of energy which this Nation needs.

In the spring of 1980, an ad hoc committee on energy in agriculture was organized under the auspices of the Joint Council to examine agriculture's capacity both to conserve energy and to develop self-sufficiency in energy production. The committee involves all segments of the Department of Agriculture as well as the land-grant system of teaching, research, and extension.

The staff of this committee has developed a succinct summary of each of the USDA programs which focus on energy in agriculture and a directory of key people involved in each program. The second phase of this effort involves gathering similar information from other agencies, including the Department of Energy, the

National Science Foundation, the Office of Science and Technology Policy, the Office of Technology Assessment, the Department of Commerce, and the Department of Transportation.

The ad hoc energy committee also held a conference involving all of the Federal agencies with significant energy programs and representatives of the land-grant system. The purpose of this conference was to increase coordination and communication between programs concerned with energy in agriculture.

A major national policy was set forth in the Energy Security Act of 1980, often referred to as the Synfuels Bill. Subtitle C of Title II of the Act will have the most important implications for agricultural science and education programs. This section concerns model demonstration biomass energy facilities, research and demonstration projects, and educational and technical assistance programs.

Although major new authorizations have been given, uncertainty remains over the roles and coordination responsibilities of the USDA and the DOE. A Congressional Investigation Committee criticized both the USDA and DOE and suggested methods for improving the situation.

Program Accomplishments

- Two USDA agricultural energy centers have been established to promote better coordination between research and extension programs and between SEA base-funded programs and those funded by the Department of Energy. The Southern Energy Center at Tifton, Georgia, is concerned with on-farm energy development including solar, methane, wind, small-scale alcohol, and biomass energy production and conversion. The Northern Energy Center at Peoria, Illinois, conducts research on screening, genetic improvement, production, and conversion of crops specifically grown for energy or as petrochemical substitutes.
- Additional progress was made in the development of solar energy technology for farm applications. Technology for solar heating of livestock shelters and greenhouses and for solar drying of crops, fruits, and vegetables has been developed by scientists in the USDA, State agricultural experiment stations, and private industry. This technology is being utilized by increasing numbers of farmers. Technology for heating of livestock shelters and crop drying is being demonstrated on farms through the Cooperative Extension Services with DOE financial support.
- Research on energy conservation in agriculture is largely conducted as a component of other studies. Projects on energy use in crop production and processing have investigated such topics as energy efficiency in the use of fertilizers and water, minimum tillage, and grain drying. In livestock production and marketing, energy use is studied in areas such as environmental control, waste management, and energy-efficient processing.

- Cooperative Extension Services have active energy conservation programs in all States. Although data on the savings from energy conservation are not available, the importance of energy conservation to the Nation has been stressed and information on ways for rural America to become more energy efficient is widely disseminated.
 - Extension conducts a wide range of activities designed to reduce energy consumption in agricultural production. These include programs on farm equipment selection, maintenance, and operation; irrigation scheduling; minimum tillage; fertilizer use and placement; and insulation and ventilation of livestock shelters.
 - Home economics educational programs are helping families reduce energy requirements in housing and family living.
 - 4-H and youth programs are creating an awareness of the energy situation and the importance of energy to people and their environment.
- Economic research in ESS has focused on the demand for energy in agriculture and the production of energy from farm-produced biomass. The results show that farmers and processors are responsive to rising energy prices and that rising costs will have a marked impact on farm income and consumer costs.
- The Bureau of the Census is conducting an energy survey as a follow-up to the 1978 Census of Agriculture. This will provide State and national data on energy-using equipment and energy storage facilities on farms.
- Research conducted or supported by the Forest Service has focused on the conservation of energy in silviculture, wood processing, and wood utilization and on energy production from renewable sources.
 - Energy-efficient equipment is being designed and evaluated for forest production and harvesting operations.
 - Press-drying of paper, a new process in which more water is squeezed instead of baked out of pulp, is being developed and tested.
 - In wood building construction, researchers are stressing energy-saving practices such as insulation, proper house orientation, and solar heating and cooling to augment the energy-efficient characteristics inherent to wood materials.
 - A new mobile chipper is being developed by the Forest Service, the Department of Energy, and several pulp companies to recover material now being burned in the field prior to reforestation.

Acid Precipitation

The acidity of precipitation has been increasing in recent years, and this is the suspected cause of serious environmental damage in many parts of the world, including Scandinavia, Northern Europe, Japan, Canada, and Northeastern U.S. Mountain lakes in New York have become devoid of fish partly because of increasing acidification resulting from acid rain. Adverse effects on crops and forests are suspected. The increase in rainfall acidity is the result of higher levels of sulfur and nitrogen compounds in the atmosphere, primarily from the combustion of fossil fuels.

President Carter identified Acid Rain as a major energy related environmental problem in his 1979 Message on the Environment and established an interagency committee to recommend a plan for comprehensive assessment of the problem. The interagency committee is co-chaired by the EPA and USDA. Their draft Federal Acid Rain Assessment Plan, which is currently being reviewed, calls for two central thrusts:

- A permanent program for systematic measurement of trends in the intensity and geographic distribution of wet and dry acid deposition in the U.S.
- A program of research to determine the consequences of existing and potential levels of acid deposition.

The Congress has authorized actions similar to those called for in the plan in Title VII of the Energy Security Act of 1980. Sections 702-708 establish a 10-year program to study acid precipitation and atmospheric carbon dioxide, with \$50 million authorized for the acid precipitation study and \$3 million for the carbon dioxide study. These sections are congressional reinforcement of the Presidential Directive dated August 2, 1979, which established the National Atmospheric Deposition Program.

Acid rain is a central theme in negotiations for a U.S.-Canada transboundary air pollution agreement. The USDA chairs an Impact Assessment Work Group in support of these negotiations. Good interaction exists between those involved in assessment efforts in each of the two countries.

Program Accomplishments

- The State agricultural experiment stations and the Forest Service, USDA, took a strong early interest in acid deposition and developed a network of sampling sites throughout the U.S. that is providing data essential for assessing the biological effects. The effort is now organized as Regional Research Project NC-141 and is known as the National Atmospheric Deposition Program. Currently, weekly measurements are made at 70 sites. Twenty-one of these sites have been sampled weekly since 1978. Several Federal and State agencies are participating in the program.

- Scientists in the USDA and cooperating State agricultural experiment stations have initiated studies designed to assess the consequences of acid rain on crops, forests, soils, and water.

Small Farms

The agricultural science and education system continued to address primarily four small-farm issues in 1980, and several specific activities were launched or completed. The primary issues addressed were: (1) the development of adequate descriptive data on small farms; (2) small-farms research planning and management; (3) educational assistance to small-farm families; and (4) technical assistance to small-farm families.

The Joint Council on Food and Agricultural Sciences issued the report Research, Extension, and Higher Education for Small Farms. Among the report's "Suggestions for Action" were a substantial increase in small-farms research and extension funding and the inclusion of small-farm representation in the Joint Council's regional and national planning and coordinating structure.

Program Accomplishments

- Descriptive Small Farm Data. A lack of information about the characteristics and goals of the small-farm population has been a major impediment to the design and delivery of research and education programs targeted to that population. Efforts which addressed this issue during the past year are as follows:
 - A paper prepared in the Economics and Statistics Service provides estimates of the number of small-farm families by State. Additional data will be available from a special Farm Finance Survey that is being conducted as a follow-up to the 1978 Census of Agriculture.
 - A substantial regional research effort has begun to explore the factors influencing the survival of small farms in the South. Plans have been developed for surveys in northern Mississippi and in southern Tennessee to examine small-farm resources, income sources, and opportunities.
- Small-farms Research Planning and Research Management. Small farms have received special research attention for only the past 2 or 3 years. Last year substantial efforts were made by a number of institutions to determine the extent and nature of the need for additional small-farms research and to determine how funds should be administered to obtain optimum results.
 - A large number of small-farm related research projects are underway in the state universities addressing a wide range of topics, including appropriate technology, nontraditional farm animals, and marketing alternatives.

- To improve the management of SEA/AR small-farms research programs, three regional small-farms research centers were designated at Beltsville, Maryland; Charleston, South Carolina; and Booneville, Arkansas. The programs at each site are being closely coordinated with extension field personnel.
- The needs of small, private wood-lot owners were addressed through research activities of the Forest Service. Established program priorities range from investigation of the tax structure to technical assistance.
- Educational Assistance to Small-Farm Families. Considerable work has been done in developing and testing alternative extension approaches to more effectively serve the educational needs of small or part-time farmers.
 - Many State Extension Services are redirecting increasing amounts of their budgets and resources to pilot projects which utilize special programs and paraprofessionals to reach the small-farm family.
 - All State Extension Services are directing some effort toward small family farms as part of their on-going programs. In many counties, 50 to 75 percent of the farmers are small and part-time farmers.
 - The 1890 land-grant institutions and Tuskegee Institute are cooperating with the 1862 land-grant universities in conducting small-farm programs. In several States, the 1890's and Tuskegee lead these programs.
 - A national workshop on programs and methods of working with farmers with limited resources was co-sponsored by SEA and TVA.
- Services to Small-Farm Families. As in educational programs, small-farm families have often failed to participate in service or assistance programs. At issue here are the questions of: (1) whether these programs are biased against small-farm operators, and (2) what roles the science and education agencies can play in enhancing the delivery of these programs to small-farm families. Specific activities and accomplishments include:
 - SEA and ESS staff were heavily involved with the implementation of the USDA small-farm assistance program. In each State, extension staff served on the State Small-Farm Committees, and at the county level efforts were stepped-up to inform small-farm families of services available to them. A national survey of current small-farm programs and activities was compiled as a reference and guide to successful programs.

- As budgets permit, Extension Services are participating in the 17 USDA Small-Farm Assistance Projects initiated in 1979 by providing farm management expertise and paraprofessionals for one-on-one contact with the farmers. These projects are stressing cooperation at the State and county levels between all USDA agencies, State and local agencies, and ACTION and the Community Services Administration to see if a concerted effort for small family farms will increase the benefits.
- Through the Forestry Incentives Programs, the Forest Service joined with the Agricultural Stabilization and Conservation Service (ASCS) and the Extension Service in implementing the Agricultural Conservation Program (ACP). In New England, special emphasis was placed on small wood lots providing firewood for energy reasons.

Manpower Assessment

The Office of Higher Education, SEA, USDA, conducted a Manpower Assessment Project (MAP) which examined the relationship between current and projected supply of and demand for graduates of higher education in the food and agricultural sciences. Employment demand comes from business, industry, government, education, the military services, and the international arena. Supply refers to associate, baccalaureate, master's, and doctoral degree graduates in the food and agriculture sciences including natural resources, forestry, veterinary medicine, and home economics, from all public and private institutions.

Findings of the MAP should provide a much sounder basis for educational planning with respect to identifying:

- Academic areas which warrant increased efforts and resources for recruiting students, strengthening curricula/facilities/equipment, and developing faculty.
- Academic programs which warrant stable or decreased resources because they are producing an adequate number of graduates to meet projected labor force requirements.
- International employment opportunities for American students educated in the food and agricultural sciences.

Program Accomplishments

- The first phase of this continuing effort to conduct a comprehensive supply/demand analysis focused on degree levels and occupational employment of graduates of higher education in agriculture, natural resources, and veterinary medicine. Data assembled in this phase of the project indicate:
 - Through the mid 1980's estimated supplies of associate and baccalaureate degree recipients appear to be adequate for most types of employment demand.

- Current and projected supplies of graduates with advanced degrees do not appear adequate for employment demand.
- To strengthen the food/agriculture labor force, the United States needs more master's graduates in agricultural business and management, agricultural engineering, animal sciences, food sciences, natural resources, plant sciences, and soil sciences.
- Shortages of graduates in selected specialties in veterinary medicine (e.g., regulatory medicine, pathology) will occur.
- The second phase of the project, focusing on home economics, is nearing completion. A report expected to be available for distribution in February 1981 will identify graduate supply/demand according to 11 educational clusters and seven occupational clusters, covering various fields within professional home economics.
- Phase three of the project, which will focus on graduate supply and demand in relation to sex, background, and race, should be completed during the late summer of 1981. This report will examine supply of and demand for agriculture, natural resources, and veterinary medicine graduates in relation to demographic characteristics.

PROCESS ACCOMPLISHMENTS AND PROGRAM REDIRECTIONS

Establishing effective channels of communication among and between the providers of science and education services and the users of these services is fundamental to the continued improvement of the system. Progress has been made toward improving the mechanisms for planning, coordination, and evaluation of programs. Several of the process-improving activities affecting the food and agricultural sciences are summarized below. Recent redirections of program efforts are also described to illustrate the responsiveness of this decentralized system to changing needs and priorities.

Planning, Coordination, and Evaluation

A central theme of the activities described below is that they have aided people with diverse interests and expertise to develop a consensus regarding program needs and opportunities.

Renewable Resources Extension Act (RREA) Plan

The 1978 RREA required the development of a 5-year national plan for a renewable resources extension program. Since 71 percent of the commercial forest lands and 64 percent of the rangelands in the contiguous United States are privately owned, such a program is extremely important for improving the supply of renewable natural resources.

The 5-year plan was completed and submitted to Congress on May 29, 1980. It was developed through extensive interaction of private, State, and Federal groups. Four regional conferences were held to identify major needs and to develop a proposed program.

The plan proposes an intensified program of extension education and information for owners, processors, and users of renewable resources, including fish, wildlife, forage, outdoor recreation opportunities, timber, and water. The program addresses five program areas: forest land management, rangeland management, fish and wildlife management, outdoor recreation and environmental management, and public policy.

Five-Year Research Projections, 1979-1984

The Interim National Research Planning Committee and the four Regional Planning Committees, operating under the auspices of the Joint Council, published in July 1980 the fifth biennial cycle of 5-year research projections. This report is important because it summarizes the thinking of USDA and State research administrators across the country regarding appropriate directions for research during the 1979-1984 period. The participants in the projection process included administrators of 56 State agricultural experiment stations (including forestry departments); 16 schools of forestry; 16 land-grant colleges established in 1890 and the Tuskegee Institute; and USDA agencies with major research functions including the Science and Education Administration, the Forest Service, and the Economics and Statistics Service.

Participation of the Science and Education System in Two Major National Planning Activities

- The Soil and Water Resources Conservation Act (RCA) of 1977. This act directed the Secretary of Agriculture to:
 - Appraise the soil, water, and related resources on the nonfederal land of the Nation.
 - Develop a program for furthering the conservation, protection, and enhancement of these resources.
 - Report to Congress and the public on the above in 1980.
 - Provide Congress with annual evaluation reports thereafter.
 - Repeat the above four steps in 1985.

The 1980 appraisal and program report has been prepared and provides the groundwork for the conservation programs that Americans will need to keep up with demands on soil and water resources between now and the year 2030 and beyond. In developing this report the Soil Conservation Service, USDA, was assisted by the science and education agencies of the USDA and other Federal departments. The public made a major contribution to this report through some 9,000 local meetings during the summer and early fall of 1978 attended by 164,000 people. Additional public participation was obtained in the review of written materials and briefing sessions on the plan.

- Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974. In September 1980 the Forest Service published the second recommended program as required by the RPA. This report, A Recommended Renewable Resources Program--1980 Update, and a companion document, An Assessment of the Forest and Rangeland Situation in the United States, are technical documents supporting the 1980 Report to Congress on the Nation's Renewable Resources.

Development of these RPA reports involved citizen participation through meetings held nationwide. Other Federal, State, and private organizations also participated in this planning process, including several elements of the science and education system.

Cooperative Extension Evaluation

In the Food and Agriculture Act of 1977, the Congress requested "...an evaluation of the economic and social consequences of the programs of the Extension Service and the Cooperative Extension Services." In response, a report was published in January 1980 which includes extensive background on extension programs in agriculture and natural resources, home economics and nutrition, 4-H youth, and community and rural development. Major policy issues are also discussed. This is an important document because it provides an overview of extension programs and the issues which these programs address.

Response to Users Advisory Board Recommendations

The National Agricultural Research and Extension Users Advisory Board is assigned a key role in advising organizations represented on the Joint Council about appropriate levels of resource allocation and priority needs for research and extension. One of the Board's functions is to critique the annual USDA science and education budget in terms of its responsiveness to the Board's recommendations. This interaction is designed to introduce more of the users' perspective into resource allocation decisions at the Federal level.

In their March 1980 "Report to the President and Congress" regarding the FY 1981 Federal budget, the Board indicated that:

- It was not satisfied with the total level of funding proposed for agricultural research and extension.
- Proposed increases for research on the structure of the agricultural industry were appropriate and the needs of all family-owned farms should be emphasized. Also, increased funding is needed for research on structural effects of tax laws and for monitoring foreign investment in the U.S.
- It strongly endorsed increased support for basic research.
- Increased support for IPM, including more extension work in IPM, is needed.
- It generally was satisfied with requests for energy programs but recommends additional funds for the extension of known technology.
- The request relating to water-use efficiency is inadequate.
- With worldwide food security a major concern, the budget for research and extension dealing with food production, is insufficient.
- It generally supports the request related to human nutrition but recommends that the dissemination of known information be given higher priority.
- The budget request concerned with loss of soil quality and the removal of land from agricultural use was unsatisfactory.

Joint Budget Displays for USDA Science and Education Agencies

To further improve the coordination of USDA science and education programs, the Council encouraged increased interaction among USDA agencies in developing their respective FY 1982-84 program recommendations to the Secretary. This resulted in staff papers which highlighted the complementary and supplementary aspects of the respective agencies' proposals. In addition, a Science and Education Overview statement was prepared and presented to the Secretary and his policy staff. This statement provided: (1) descriptions of current programs and funding levels, including best estimates of levels of effort of cooperating universities, other Federal agencies, and the private sector; (2) mutually

supportive FY 1982 initiatives, themes, and issues; (3) joint displays of budget requests in selected areas, and (4) potential impacts of major initiatives.

Redirection of Program Resources

A charge sometimes leveled at science and education programs is that after programs are initiated, they seldom change. However, the historic record shows that program emphasis has changed and redirections of resources have occurred.

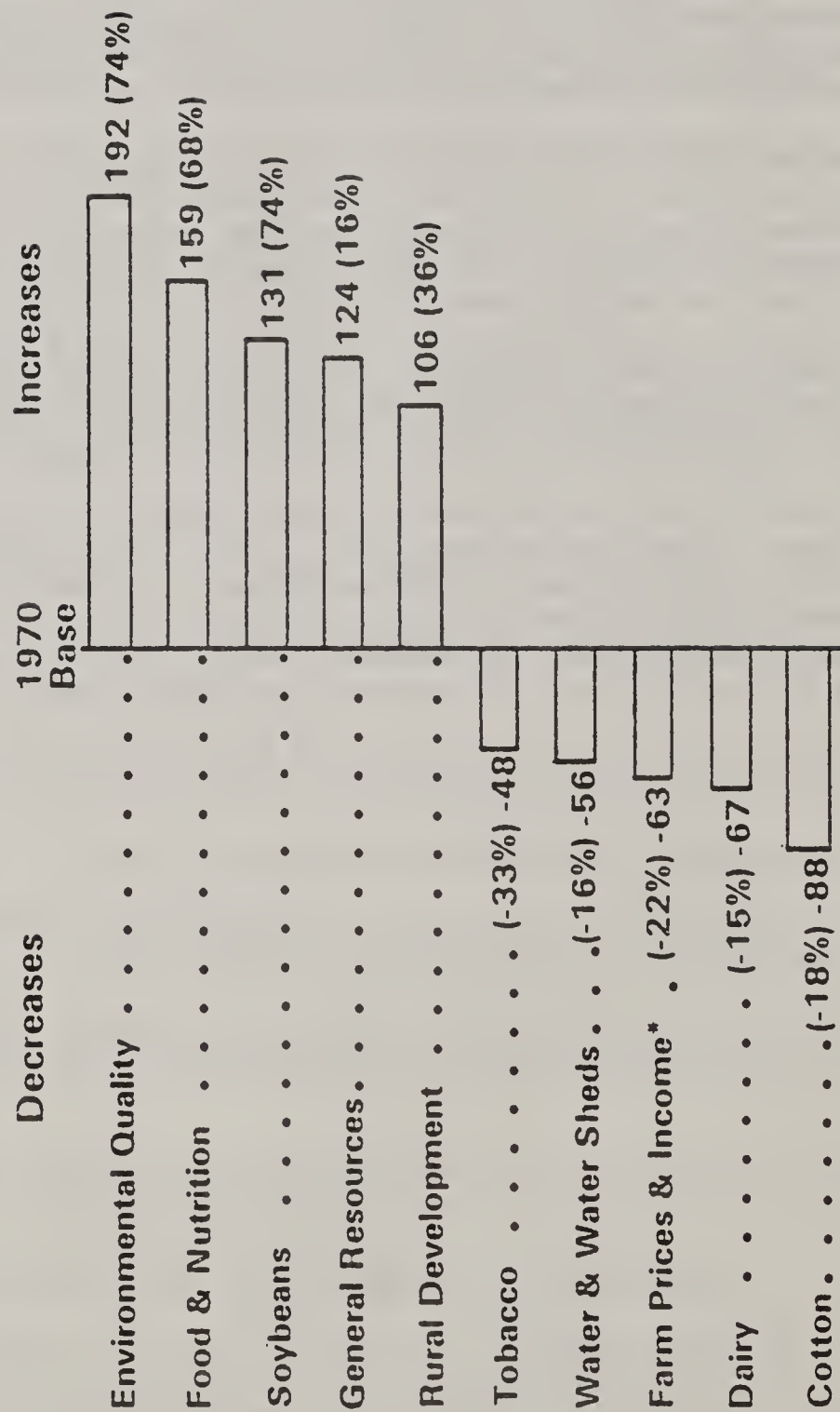
Changes in the allocation of scientist years by research program during the 1970-1979 period are shown in Figure 2 for all USDA agencies, State agricultural experiment stations, schools of forestry, and 1890 schools and the Tuskegee Institute. During this period, there were sizeable and significant shifts away from research on cotton, dairy, tobacco, poultry, sugar, sheep, wool, and fruit. Significant increases were recorded for program areas like food and nutrition, environmental quality, rural development, soil and land use, forage/range/pasture, forestry research, beef, and soybeans. The total number of scientist years increased by about 9 percent over this period.

Changes in professional-staff years of extension effort from 1971 to 1979 are shown in Figure 3 for major program areas. There were shifts away from work in human nutrition, home economics, farm management, and 4-H to greater emphasis on crop and livestock production management, natural resources and environment, rural and community development, and improved family living. These redirections occurred within the context of an 11 percent increase in total staff years.

Figure 2

Changing Research Emphases Scientist Years, State/Federal System

1970-79

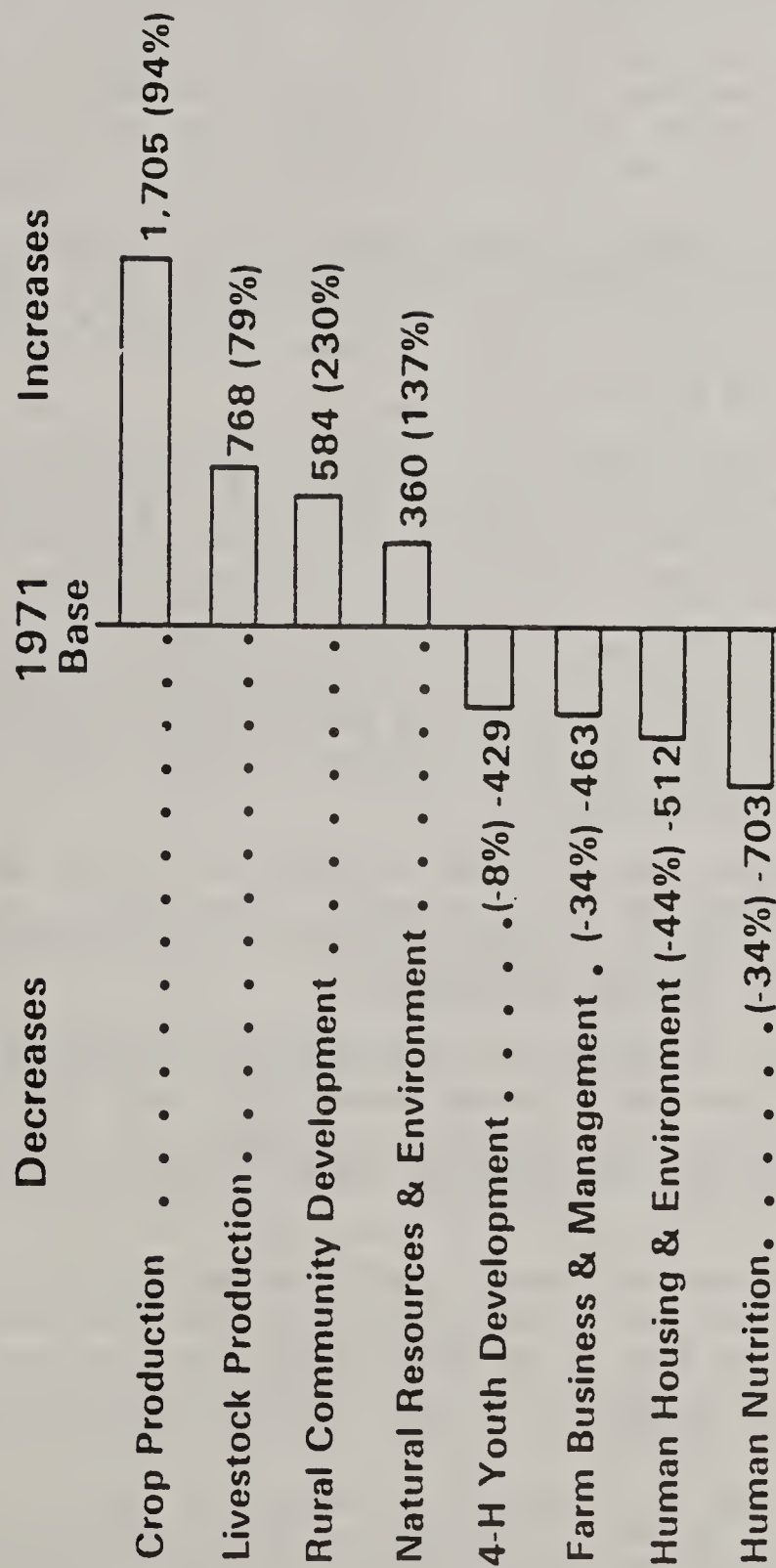


*Includes Farm Adjustments

Figure 3

Changing Cooperative Extension Emphases

Major Program Changes, Staff Years, 1971-79



PROGRAM PRIORITIES--AREAS OF INCREASED EMPHASIS

The Joint Council's recommendations for future program directions in the food and agricultural sciences are shaped by an assessment of current and prospective economic and technological conditions. Some of the major challenges and opportunities identified in the assessment include:

- The world's population by the turn of the century will be more than 50 percent larger than today. This growth, coupled with only modest additional shifts in diets from plant to animal products, implies that the world could easily absorb a doubling of total food output.
- This Nation depends on massive agricultural exports to help offset its trade deficit in non-agricultural products. U.S. agricultural exports likely will reach \$40 billion in FY 1980, with a net agricultural trade balance of over \$20 billion. Meanwhile, the net non-agricultural trade deficit could top \$50 billion.
- Inflation remains among the most serious economic problems in this country and throughout much of the world. Technological progress is one means for slowing the inflationary spiral. Yet productivity advances have slowed in many sectors of the economy in recent years.
- The rate of increase in farm productivity has declined from 2.7 percent annually during 1950-65 to a 1.7 percent during 1965-79. There is widespread concurrence that our base of unused knowledge and technology is very low and must be replenished if productivity growth is to keep pace with rising demand.
- The production, storage, and distribution systems for agricultural and forest products must continue to fight losses caused by adverse weather and pests. And, they must do so without introducing hazards to human health and the environment.
- The industry structures for production and marketing of agricultural and forest products are becoming increasingly more complex and economically interdependent. This increases the demand for economic intelligence in both managerial decisionmaking and public policy formulation and program operation.
- Our agricultural and forest industries are heavily dependent on petroleum-based fuels and vulnerable to international instability. At the same time, many of the natural resources and raw materials associated with agriculture and forestry offer the potential for reducing our dependence on fossil energy, especially foreign oil.
- U.S. croplands are losing about two billion tons of soil annually. These losses not only contribute to stream and river pollution but also threaten the future productivity of our land. Millions of acres of prime croplands have also been lost to non-agricultural development.

- The water supply for agricultural use is diminishing and becoming one of the most limiting resources for future crop production in many parts of the country. Competition for limited water supplies can be expected to intensify in years to come.
- The American people demand improved worker and consumer safety associated with the products of agriculture and forestry. Consumers are increasingly concerned about the nutritional adequacy and health implications of their diets.
- Energy shortages, inflation, and unemployment have refocused the public's attention on goals of economic growth and increased productivity. The food and agricultural sciences have much to offer in furthering these goals as they relate to the production and delivery of market goods and services.

The specific issues above are encompassed in the overall quest for general improvement in the quality of life. Research and education must continue to contribute to the broader goals of society which relate to the development and well-being of individuals, families, and communities throughout America.

Based on these considerations, the Joint Council concludes that real growth in the resources devoted to the food and agricultural sciences is essential to the well-being of this Nation. As a first step, the Council recommends that highest priority be given to maintaining strong base programs across the entire range of disciplines and organizations which comprise the food and agricultural science system. This means that increased funding must be provided to offset the effects of inflation and maintain a stable foundation on which to build to address the challenges and opportunities of the future.

Long-range development of the food and agricultural sciences is highly dependent upon an adequate supply of professional workers. The shortage of professional expertise predicted by the Manpower Assessment Project must be addressed. This calls for an increased supply of graduates of higher education in the food and agricultural sciences.

The Joint Council has identified four areas which should receive additional program emphasis during the coming year: productivity, energy, natural resources, and human nutrition. More specific recommendations for expanded programs in each area are described below.

Productivity

Productivity increases in the short run may be translated into improved incomes for producers or more favorable prices for consumers. By making U.S. products more competitive on world markets, productivity increases also contribute to increased exports and a more favorable balance of trade. The rising cost of energy and other inputs makes the latter an extremely important objective for this Nation. In the longer run, productivity increases can improve standards of living for an expanding world population.

The size and scope of present-day agricultural and forest industries, including their geographic and climatic diversity and the complex technologies which they now employ, mean that significant improvements in productivity can be expected only if problems are systematically approached across a broad front. Therefore, the Joint Council recommends:

- New initiatives in basic research to unlock more of nature's secrets relating to plants, animals, and pests, including:
 - Gene manipulation, genetic splicing, and recombinant DNA knowledge.
 - Molecular biology of pests and diseases.
 - Plant and animal metabolism and biophysical mechanisms.
- Expanded programs of applied research and extension to improve agricultural production efficiency, including efforts in:
 - Animal health, protection, and reproduction.
 - Crop management systems.
 - Plant germplasm, microbe, and insect collections.
 - Integrated pest management and biological control strategies.
 - Aquaculture systems.
- Expanded research and extension programs in marketing efficiency and in improved data and economic analyses for decisionmaking, including programs on:
 - Alternative production practices and costs.
 - Policies related to the structure and performance of agricultural markets.
 - Marketing systems and practices.
 - Means to reduce food losses and maintain product quality.
 - Alternative transportation systems for agriculture.
 - Analysis of regulations related to agricultural production and marketing.
- Expanded research and extension programs to increase productivity in timber production, harvesting, and processing, including programs on:
 - Relationships between fertilization and tree growth on various soils.
 - Genetic resistance of trees to insects and disease.

- Lower cost techniques for site preparation and tree planting.
- Improved methods of biological pest control.
- Development of cost-effective whole-tree harvesters.
- Improved technology for manufacturing reconstituted wood products.
- Improved papermaking techniques that would allow for more use of hardwoods.
- Innovations that encourage the energy self-sufficiency of processing plants.

Energy

Current and prospective energy supply-price conditions affect this Nation's ability to produce and distribute agricultural and forest products. Therefore, the Joint Council recommends significant expansions of energy-related programs in the food and agricultural sciences. For agriculture, increased emphasis is recommended for programs related to:

- Conservation of energy in agricultural production through improved tillage practices, improved fertilizer use, irrigation efficiency, nitrogen fixation, and other means.
- Use of alternative energy sources in agricultural production including the sun, wind, methane, alcohol, and vegetable oils.
- Selection, genetic improvement, production, and harvesting of biomass for fuels, hydrocarbons, and petrochemical substitutes.
- Development of a reliable data base pertaining to the use of major types of energy on farms and the economies of that use.
- Assessment of the environmental impacts of biomass production for energy (for example, effects of crop residue removal on long-term crop productivity, soil erosion, etc.).
- Utilization of energy production by-products (for example, feeding stillage and residues from methane digestors to livestock and using waste heat from power generation in agriculture).

Increased emphasis in forestry programs is recommended on:

- Updated inventory, assessment, and evaluation of wood biomass.
- Expanded information and technical assistance programs to put wood-for-energy technology to use.

- Improved systems to harvest and deliver residue wood to users.
- Improved systems for direct combustion.
- Improved systems for converting wood into alcohols and hydrocarbons.
- Energy from fuel plantations.

Natural Resources

Increased concerns for natural resources and the environment stem in part from projected future needs for the traditional products of agriculture and forestry and the need to maintain a productive resource base for future generations. These concerns are heightened by burgeoning demand and increased competition for the same natural resource base for a variety of non-agricultural uses. Therefore, the Joint Council recommends a general expansion of science programs in natural resources which relate to:

- Soil and water use on agricultural cropland, including:
 - Improved water use efficiency on both irrigated and non-irrigated cropland.
 - Improved recharge of groundwater bodies.
 - Determination of soil erosion/productivity relationships.
 - Improved conservation tillage systems for critically eroding areas.
- Establishment of a comprehensive, consistent land and water resource data base providing information on:
 - Land ownership, tenure, and value.
 - Land use, conservation investments, and management practices.
 - Water use, sources, quality, conservation measures, and management systems.
- Improved management and utilization of eastern hardwood resources, including:
 - Increased opportunities to manage hardwood forests on small private ownerships that will result in higher returns, improved stands, and better wildlife habitats.
 - Development of utilization and marketing technology to permit substitution for softwoods.
- Research and extension for range resources, including:

- Development and improvement of integrated range improvement practices for increased productivity.
- Evaluation and demonstration of the compatibility of livestock grazing with other uses.
- Basic research leading to improved understanding of the structures, processes, and genetic diversity of forest and range organisms and ecosystems.

Human Nutrition

Improving human diets and developing consumer skills in food buying and preparation have long been recognized as important functions of the food and agricultural science system. However, the scope and prominence of consumer interests and issues has increased markedly in recent years. Despite this increased concern, we know far less about the nutritional status and needs of humans than is required to assist consumers in making rational food choices or to assist public policy decisionmakers in the formulation and operation of food programs.

The Joint Council recommends that expanded programs in human nutrition include:

- Increased research relating to the nutrient composition of foods.
- Increased research on human nutritional requirements for growth, development, and disease reduction, with emphasis on infants, pregnant or lactating women, and the elderly.
- Further development of techniques for monitoring and analyzing dietary intake and nutritional status.
- Determination of factors influencing food preferences and acceptability.
- Evaluation of government policy options relating to human nutrition, including intervention and assistance programs.
- Evaluation of the impacts of changing market structures and institutions on the availability, quality, and price of foods to consumers.
- Expansion of nutrition information and education programs to improve diets.

APPENDIX

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